TIME USE AND CLASS PERFORMANCE: THE MARGINAL BENEFIT OF STUDY TIME

HONORS PROJECT

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by

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ABSTRACT

Recursive regression analysis revealed that the amount of time spent studying was positively related to quarter GPA for 80 students at a large midwestern university enrolled in three different agricultural economics courses. However, substantial increases in study time are necessary to improve quarter GPA by one full letter grade. Two variables, working and sleeping, significantly and negatively impacted the amount of time a student studies. Commitment to academics was not significant if related to quarter GPA or the amount of time spent studying, but it was significant if related to the amount of time scheduled to be in class. As originally designed, this study attempted to test for a relationship between learning styles and academic performance. However, a lack of variation in the measure of learning style used in this study precluded the incorporation of learning styles into the regression analysis.

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INTRODUCTION

A fundamental belief on which the U.S. was built is that effort shall lead to a fitting reward. Consistent with this belief is the idea that a student's class performance should reflect the amount of effort put into the class. Although the magnitude of the relationship varies, recent research has shown that, when specified within a multiple-variable, multiple-equation system, the amount of time spent studying is positively related to grades (Frisbee, 1984; Lahmers and Zulauf, 2000; Pappalardo 1986; and Schmidt, 1983). Furthermore, research has found that the student's effectiveness in using time (i.e., time management ability) and academic performance are positively related (Lahmers and Zulauf, 2000 and Macan et al., 1990). When combined, this body of research suggests that both the quantity and quality of time devoted to academics affects academic performance.

This study builds on the research of Lamhers and Zulauf (2000). They find that, while an increase in the amount of time spent studying increased quarter GPA, magnitude of the increase was small. Specifically, it took a 40-hour increase in study time to increase quarter GPA by one letter grade. This finding raises questions about the fairness of the observed effort-reward relationship.

Lamhers and Zulauf suggest that omitted variables may be one reason that their marginal value of study time is low. They specifically suggest adding measures of learning styles and commitment to academics. Research has found that learning styles are associated with distinctly different preferences for learning and is a determinant of

how a student learns most effectively (Cano, 1992; and Witkin et al., 1971). Commitment to academics is a measure of motivation. It has been widely documented that motivation influences behavior and thus, performance.

METHOD

The study's sample is students enrolled in three classes offered by the Department of Agricultural, Environmental, and Development Economics (AEDE): AEDE200, Fall Quarter 1999 and Winter Quarter 2000, and AEDE247, Winter Quarter 2000. The first is an introductory course in microeconomics while the second is a lower-level course that explores career opportunities within the major of agribusiness and applied economics. Students in these courses come from a wide variety of majors, but most are in the College of Food, Agricultural and Environmental Sciences.

Students kept a time diary for a one-week period as recommended by Robinson and Goodbey (1997). Students recorded their use of time throughout the week in half-hour increments. Pre-assigned categories were provided: in-class, studying, eating, sleeping, job, travel telephone, television, planned recreation/leisure, student organizations/activities, personal hygiene, shopping, and other. Surveys were taken during the fifth through seventh week, depending on the course. The intent was to stay away from the first two weeks of the quarter, when studying may be less than normal, and the last two weeks of the quarter, when studying may be more than normal. Students may spend more time studying during a midterm week than most other weeks of the quarter.

A second survey, the Time Management Behavior Scale™ (TMB), was used to measure time management ability. This questionnaire was obtained from Therese Hoff Macan, of the University of Missouri- St Louis. TMB consists of 34 questions that measure four primary attributes of time management: preference for organization in completing tasks, setting goals and priorities, perceived control over time, and use of time management techniques. The questions are scored on a scale of one to five, with one indicating a weak preference and five a strong preference for the desired time management behavior.

Five survey instruments are commonly cited in the learning styles literature (Schmidt and Javenkoski, 2000): 1) The Embedded Figures Test for field dependence and field independence (Witkin, 1971); 2) Gregorc's Learning Style Delineator (Gregorc, 1985); 3) Kolb's Learning Style model (Boyatzis and Kolb, 1991); 4) Myers-Briggs Type Indicator (Wilson, 1998); 5) The Learning Styles Inventory by Rita and Kenneth Dunn, created in 1979 (Wilson, 1998). This analysis used the Group Embedded Figures Test (GEFT) for two reasons. Research has shown that GEFT is a reliable test; consistent over repeated testing (Cano, 1992). It is also simple to administer for large groups.

In addition to the surveys, students were asked several questions about their personal characteristics that may affect their use of time, such as martial status and if they had children. Students also were asked for permission to obtain information from the college office. This information included ACT/SAT score, high school rank, cumulative GPA prior to the survey quarter, age, gender, earned credit hours overall, and earned credit hours during the quarter surveyed. ACT scores were more common,

thus SAT scores were converted into equivalent ACT scores using the analysis of Doran *et al*, (1997). If more than one score existed, an average of the available scores were used in this study.

PARTICIPANTS

One hundred twenty students were initially included in this study. Some students did not complete one of the three surveys, and/or did not give permission to use their information from the college office. First quarter freshmen are in a transition period and were eliminated due to the fact that their use of time may not be comparable to students who have already adjusted to college life. These adjustments left 80 students in the survey.

Of the 80 students, 51 percent were male and 49 percent were female. Class rank of the student participants was 27.5 percent freshman, 38.8 percent sophomores, 27.5 percent juniors, and 6.3 percent seniors. Average age was 19.6. The oldest was 24; the youngest was 18. Less than four percent had each of the following characteristics: married, engaged, children, and primary care giver to another person.

The average hourly use of time by these 80 students during the one week survey period was: sleep (57.3), planned recreation (20.0), study (19.4), in class (15.8), television (11.5), travel (9.9), eating (8.2), personal hygiene (7.0), job (6.7), phone (2.7), student organizations/activities (2.0), and shopping (2.0). This use of time is similar to that reported by Lahmers and Zulauf (2000).

Males comprised 51 percent of the student participants, compared with 56 percent of the students in the college and 52 percent of the students in the university.

Average GPA of the student participants during the quarter they were surveyed was higher than the average for all students enrolled in the college during these quarters (2.92 vs. 2.81). Average cumulative GPA for the survey respondents and all students in the college were 2.88 and 2.71, respectively. Average age of the respondents was younger than the average age at the university (20 vs. 22). The younger age and higher GPA of the student participants may reflect that two thirds of the participant were first and second year students.

LEARNING STYLE

A learning style is an individual's preferred method of perceiving, interpreting, processing, organizing, storing, and retaining new and complex information (Schmidt, and Javenoski, 2000). The GEFT learning style test contains 18 problems consisting of eight simple figures embedded into more complex figures (Witkin *et al*, 1971). A score of one or zero is assigned to the response, with one indicating field independence and zero indicating field dependence. Maximum total score is 18. The closer the total score is to 18, the more field independent individual.

Field dependent learners prefer that instructors provide structure to learning activities, like to work in groups, value positive reinforcement from the instructor, are extrinsically motivated, and like detailed instructions (Cano, 1992 and Sadler-Smith and Riding, 1999). These characteristics suggest that field dependent learners may more highly value in-class time as opposed to study time. In contrast, field independent learners prefer to set their own goals and structure to learning, are not as responsive to positive reinforcement from the instructor, are intrinsically motivated, prefer to learn by

trial and error as opposed to being shown how, and are good at analytical problem solving (Cano, 1992 and Sadler-Smith and Riding, 1999). These characteristics suggest that field independent learners may more highly value study time as opposed to in-class time.

As mentioned earlier, previous studies have researched the relationship between learning styles and academic performance. Kember *et al.* examined this relationship using student time diaries and a learning style test. We also expected to find that the preferred learning style impacted the amount of study time. However little variation existed in the GEFT learning styles scores. Average score was 13.59, with a standard deviation is 3.95 (table 1). More significantly, 88 percent of the respondents were classified as field independent (score of 10 or higher). Furthermore, learning styles were not found to vary by gender, quarter GPA, age, hours studied, and hours scheduled (table 1).

A necessary condition for an empirical analysis to be successful at discriminating the relationships associated with a variable is that the variable must have a meaningful distribution. Given the overwhelming predominance of the independent learning style, it was not surprising that the regression analysis found no statistically significant relationships between the GEFT learning style and the measures of academic performance investigated in this study. Because of the lack of variation in the learning styles measure, the regression analysis discussed below does not include the learning styles measure.

While GEFT has been shown to be reliable between the two categories of learners, a finer discrimination may be useful. Many of the other learning style

indicators have four or more categories. Also, it is reasonable to speculate that college may pre-selected for field independent learners because much of the learning in higher education requires intrinsic motivation and analytical thought processes.

A study by Sadler-Smith and Riding (1999) argues that learning and cognitive styles can be classified in layers. Learning style may not be the primal distinction that needs to be made when examining the correlation between use of time, study time in particular, and academic performance. Previous studies have found that learning style influence information processing style (as found by Kolb's Learning Style model). The information processing style in turn influences instructional preferences (Sadler-Smith and Riding, 1999). Instructional preference is then the variable that could directly be related to the marginal value of time spent in class and studying for students.

REGRESSION MODEL

Previous studies which have estimated the relationship between time spent studying and grades using a multiple-equation system of have used either a system of simultaneous (Frisbee, 1984; Pappalardo, 1986; Schmidt, 1983) or recursive approach (Lahmers and Zulauf, 2000). A system of simultaneous equations assumes that the dependent variables are determined concurrently and, thus, all equations are solved concurrently (Gujarti, 1995; Maddala, 1992). In a recursive system, the dependent variables are solved sequentially. Specifically for the question being investigated in this study, Lahmers and Zulauf (2000) argue that, it is reasonable to think that students first decide how many hours of class time they will schedule. Then they decide how many hours they will

spend studying, based in part on how many hours they scheduled to be in class. Last, based in part on their previous decisions, their GPA is determined.

Because of the disagreement about the specification of the model, a Hauseman test for simultaneity was conducted (Gujarti, 1995). Results of this test rejected the hypothesis of simultaneity among the three variables, but were consistent with a recursive system.

Besides use of time, previous research has identified several factors that can be associated with academic performance. Scholastic aptitude, as measured by ACT and SAT scores, has been widely documented as a predictor of grades (for example, Domer and Johnson, 1982; Frisbee, 1984; Lahmers and Zulauf, 2000; Shuman 1985.).

As mentioned in the introduction, time management ability has been found to have a positive relationship with grades. Thus, overall time management ability from the Time Management Behavior Scale (Macan et al., 1990) was included in the quarterly GPA equation.

Number of hours spent working and sleeping were included in the scheduled hours and study time equations. Sleep is the largest use of a student's time. It is reasonable to hypothesize that it may be negatively related to hours of scheduled class time and hours of study time. Results from previous studies have been mixed with regard to the influence of hours spent working on academic performance (e.g. Lahmers and Zulauf, 2000).

Gender is a dummy variable, with 0 meaning female and 1 meaning male. Age is highly correlated (.68) with number of credit hours completed. Thus, it is a measure of both chronological maturity and academic experience. While the significance of age and

gender varies across studies, these variables are usually included in analyses of academic performance because of their interest to researchers and as a way to control for differences that may arise among samples.

A measure of commitment to academics was included as a variable. The question measuring commitment to academics was worded "On a scale of 1-10, where 1 is not interested, committed, and enthusiastic, and 10 is completely interested, committed, and enthusiastic, what is your level of interest, commitment, and enthusiasm for your program of study at Ohio State?" This question gives a measure of how committed in general the respondent was to academics.

This study also asked the student respondents what GPA they hope to earn during the quarter. A reasonable expectation is that the higher the hoped for GPA, the fewer hours of class time a student would schedule and the greater the number of hours that the student would study (Lahmers and Zulauf, 2000). Both of these responses are expected to lead to a higher quarter GPA.

Table 2 contains a summary of the descriptive statistics for the variables used in the regression analysis. The average survey respondent had a quarter GPA of 2.9 compared to a hoped for GPA of 3.5. The students, on average spent 6.7 hours working and 57.2 hours sleeping per week. They had an average of 15.2 scheduled class hours. The range of the TMB was 2.2 to 4.2 with an average score of 3.3.

RESULTS

Results of the regression analysis are presented in Table 4. R^2 varied from 0.19 to 0.31. R^2 is a measure of the variation of the dependent variable explained by the group of

independent variables. The R^2 obtained for the equations in the recursive system are within the range commonly obtained for cross sectional data.

Only one variable is significantly related to the number of hours scheduled to be in class, using a five percent level of statistical significance: commitment to academics. It had a positive relationship.

In the second equation, hours scheduled to be in class is positively related to study time using the five percent level of statistical significance. Amount of time spent working and sleeping are significantly and negatively related to study time.

In the third regression equation, three variables are significantly and positively related to quarter GPA. They are amount of time spent studying, ACT score, and age. The finding on ACT score is consistent with previous research.

Although a five percent level of significance is used in this study, there is no definite answer as to the appropriate level of significance to use. Another commonly used level of significance is ten percent. At this significance level, age, gender, and hoped for GPA are significantly and negatively associated with scheduled credit hours. In addition, time management ability is significantly and positively related to quarter GPA. The following discussion will focus only on the independent variables that are significant at the five percent level.

DISCUSSION

From the first regression equation, as commitment to academics increases by one point on its ten-point scale, scheduled time in class increased by 0.96 hours, everything else equal. Since scheduled hours in class and credit hours earned have a correlation of .79,

the degree of commitment to academics has a significant impact on time to graduation. Interestingly, the measure of academic commitment used in this study is not a significant explanatory variable for either hours of study time or quarter GPA. This lack of significance may be the consequence of the measure used in this study or it may suggest that academic commitment's primary influence is on time to graduation. Additional studies are needed to distinguish between these two implications.

Commonly, students are advised to spend two hours studying for each hour spent in class. In contrast, previous studies have found that the observed ratio is closer to one hour of study time for each hour spent in class (Lahmers and Zulauf, 2000; Robinson and Goodbey, 1997). This study finds that for every one-hour increase in scheduled class time, study time increases by 0.65 hour. While smaller than one, this value does not differ significantly from 1.0. Thus, as with previous research, this research suggests that the conventional wisdom on the relationship between study time and class time appears to have little relevance to today's students.

Job and sleep time both are negatively related to study time. Interestingly, each additional hour of sleep and job has approximately the same impact on study time. For each additional hour of sleep, a student studied 0.28 hours less. For each additional hour of work, students studied 0.27 hours less.

Quarter GPA increases by 0.10 point as a student's age increases by one year. One possible explanation for this finding is that, the older the student, the more likely he/she is taking courses in his/her major and the less likely the student is taking required non-major courses. Thus the older the student, the more likely the courses were

self selected, either because of interest or because of relevance to the student's future career.

While study time has a significant influence on GPA, each additional hour a student studies raises quarter GPA by only .019 points (4 point scale used in this study). This marginal impact is similar to the marginal impact of .025 point per additional hour of study on quarter GPA found by Lahmers and Zulauf (2000).

Thus, consistent with Lahmers and Zulauf, this study finds what most would consider a small positive reward for additional studying. This raises questions about whether the observed trade-off is reasonable and fair, assuming that effort has a value in the classroom. On the one hand, this is a philosophical issue that needs to be discussed at the institutional level. But, on the other hand, this is an issue that individual instructors need to consider as they construct their grading scales for classes.

LIMITATIONS AND FUTURE RESEARCH

This study lends insight into how students use their time and how this time use affects major decisions every student makes, how many hours to schedule, how much to study, and, their grades. It would be useful and interesting to conduct this type of survey at different points throughout the quarter and to learn how student's time use changes throughout the quarter. This suggestion may be difficult to implement because of the burden it places on student respondents.

Although the research on learning styles did not prove informative, it is still useful to continue with this line of research. While this study used what it thought was

an appropriate measure to assess the interrelationship between study time, GPA, and learning style, another learning style test may be more appropriate. It may even be useful to use more than one learning styles test. As mentioned previously, a test of instructional preference, may be more appropriate.

It also would be interesting to look at some of the more negative factors that affect study time and GPA. A procrastination test would be useful to test how much a students procrastination tendencies affect time management and ultimately academic performance.

Another limitation of this study is based on the ethnicity of the survey respondents. There was very little diversity existent within the survey respondents based on ethnicity. There was no way to control the attendance of the classes used, however, is does limit the inferences that can be made regarding the findings of this study.

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Table 1: Learning Styles Compared to Gender, GPA, Age, Study hours, and Scheduled hours

Characteristic	Number of Observations	Mean	Median	Min	Max	Standard Deviation
Gender						
female	39	13.7	14.0	4.0	18.0	3.6
male	41	13.3	14.0	4.0	18.0	4.4
GPA						
<2.0	6	12.0	12.0	6.0	16.0	3.6
2.00-2.49	15	14.9	16.0	7.0	18.0	3.1
2.50-2.99	18	12.3	14.0	5.0	18.0	4.7
3.00-3.49	24	13.2	14.0	4.0	18.0	3.8
3.50-4.00	17	14.6	16.0	4.0	18.0	4.2
Age						
18	18	13.7	14.5	5.0	18.0	4.2
19	25	13.6	14.0	5.0	18.0	3.8
20	18	14.2	15.0	4.0	18.0	4.1
21	13	13.6	14.0	5.0	18.0	3.8
22+	6	10.7	13.0	4.0	16.0	4.7
Hours Studied						
12 or fewer	14	13.6	14.5	7.0	17.0	3.3
12.1 to 17	16	12.2	13.0	4.0	18.0	4.5
17.1 to 22	22	15.5	17.0	7.0	18.0	2.6
22.1 to 27	18	12.4	13.5	5.0	18.0	4.5
27 or more	10	14.2	15.0	4.0	18.0	4.5
Hours Scheduled						
12 or fewer	11	12.7	13.0	5.0	18.0	4.1
13-15	41	13.5	14.0	4.0	18.0	4.1
16-18	13	13.8	15.0	5.0	18.0	4.0
19 or more	15	14.5	15.0	7.0	18.0	3.6

Source: Original Survey Data

Table 2: Descriptive Statistics for Variables Used in Regression Equations

Variable	Units	Mean	Min	Max	Standard Deviation
Scheduled Class Hours	Hours per week	15.2	5.0	21.0	3.0
Time Spent Studying	Hours per week	19.7	3.0	44.0	8.2
Quarter GPA	Number	2.9	1.0	4.0	0.7
Hoped For GPA	Number	3.5	2.8	4.0	0.4
Time Spent Working	Hours per week	6.7	0.0	34.5	8.4
Time Spent Sleeping	Hours per week	57.2	43.0	73.5	5.8
Commitment	Number	7.7	3.0	10.0	1.5
Gender	Percent male	50.6			
Age	Years	19.7	18.0	24.0	1.5
ACT Score	Number	23.0	15.0	33.0	3.8
Time Mangagement Score	Number	3.3	2.2	4.3	0.5

Source: Original Survey Data

Table 3: Regression Results for Scheduled Class Hours, Study Time, and Quarter GPA

	Dependent Variable					
	Scheduled Class Hours		Study Time		Quarter GPA	
Independent Variable	Coeffficient	Standard Error	Coeffficient	Standard Error	Coeffficient	Standard Error
Hoped for GPA	-1.590	1.00	-1.740	2.26		
Time Spent Working	-0.003	0.05	-0.280*	0.10		
Time Spent Sleeping	0.000	0.07	-0.270*	0.15		
Commitment	0.950*	0.25	-0.001	0.60	0.050	0.05
Gender	-1.340*	0.75	1.410	1.68	0.097	0.14
Age	-0.410	0.28	0.210	0.61	0.100*	0.05
Scheduled Class Hours			0.650*	0.23	0.007	0.02
Time Spent Studying					0.019*	0.85
ACT Score					0.100*	0.02
Time Management Ability					0.190	0.17

* Significant at the five percent test level
Source: Original Survey Data